Method of Test for

CALIBRATION OF MEASURES USED TO DETERMINE UNIT WEIGHTS

DOTD Designation: TR 640-84

Scope

1. This method covers the procedure for determining the calibrated volume of a unit weight measure.

NOTE: Measures shall be recalibrated at least once a year or whenever there is reason to question the accuracy of the calibration.

Apparatus

2. (a) *Scale* - A scale readable to .01 pound (or 1 gram) capable of a weight measurement at any point within the range of use. The range of use shall extend from the weight of the measure empty to the weight of the measure plus its contents.

(b) *Measure* - A cylindrical container made from metal that is not readily attacked chemically. It shall be watertight and sufficiently rigid to retain its form and calibrated volume under rough usage. Measures shall be machined to accurate dimensions on the inside and provided with handles. The top rim shall be smooth and plane within 0.02 inch (0.5 mm) and shall be parallel to the bottom within 0.5 degree. Measures with a metal thickness less than 0.20 inch (5.1 mm) shall be reinforced around the upper 1.5 inch (38 mm) with a steel band to provide a minimum thickness of 0.20 inch (5.1 mm). The capacity and dimensions of the measure shall conform to the requirements of the test for which the measure is being calibrated.

(c) *Glass Plate* - Sufficient size to cover measure.

(d) *Thermometer* - Capable of measuring temperature to nearest 0.5^{o} F, or 0.3^{o} C at the temperature of the water.

(e) *Containers* - Suitable for transporting water and filling the measure for test purposes.

Procedure

3. Determine calibrated volume of the measure following the procedure outlined below.

(a) Weigh measure and glass plate together and record as (B) on the worksheet accompanying this procedure (Example 1).

(b) Fill the measure with water and cover with the piece of glass to eliminate bubbles and excess water. Clean any spilled water from exterior of measure and catch pan. Weigh the measure, glass and water together and record as (A) on worksheet.

(c) Determine the net weight of water in the measure by subtracting the tare weight (B) of the measure and glass determined in paragraph 3(a) from the gross weight (A) of the filled measure plus the glass determined in paragraph 3(b) and record on the worksheet as (C).

(d) Measure the temperature of the water, record on worksheet, and determine its unit weight from Table 1, interpolating if necessary (see example), and record as (D) on worksheet.

TABLE 1
Unit Weight of Water

Temperature		Unit Weight	
deg F	deg C	lb/ft^3	kg/m^3
60	15.6	62.366	999.01
65	18.3	62.336	998.53
70	21.1	62.301	997.97
(73.4)	(23.0)	(62.274)	(997.53)
75	23.9	62.261	997.32
80	26.7	62.216	996.60
85	29.4	62.166	995.80

EXAMPLE - INTERPOLATION

DETERMINATION OF UNIT WEIGHT OF WATER AS IN 3(d)

KNOWN: Temperature 76^{o} F

FROM TABLE 1:

Unit Weight at 75^{o} F = 62.261

Unit Weight at 80^{o} F = 62.216

BY INTERPOLATION:

62.261 - 62.216 = .045 lbs/ft^3 difference between 75^o F and 80^o F

.045 lbs/ft^3 distributed proportionally over the 5^o F (80^o - 75^o) range equals .009 lbs/ft^3 per degree temperature.

THEREFORE:

At 76^o F the unit weight of water is 62.252 lbs/ft^3 (62.261 - .009).

(e) Calculate the calibrated volume of the measure, in cubic feet, according to the following formula:

$$V = \frac{C}{D}$$

where:

V = calibrated volume
C = net weight
D = unit weight of water

Normal testing time is 2 hours.

CALIBRATED VOLUME

FOR UNIT WEIGHT MEASURES

DOTD TR 640

DATE 3-3-83

MEASURE IDENTIFICATION #52

TESTED BY HTC

CHECKED BY MT

WATER TEMPERATURE			76°F
WEIGHT MEASURE + GLASS + WATER (LB)	A		58.2
WEIGHT MEASURE + GLASS (LB)	B		35.4
NET WEIGHT OF WATER (LB)	C	A-B	22.8
UNIT WEIGHT OF WATER (LB)	D	TABLE I	62.252
CALIBRATED VOLUME (CU. FT.)	F	C/D	0.3663

Example 1